



## **Microbial biodiversity enhances micropollutants biotransformation in Moving Bed Biofilm Reactors (MBBR) with controlled biofilm thickness**

**Torresi, Elena; Fowler, Jane; Polesel, Fabio; Smets, Barth F.; Andersen, Henrik Rasmus; Christensson, M.; Plósz, Benedek G.**

*Publication date:*  
2016

*Document Version*  
Peer reviewed version

[Link back to DTU Orbit](#)

### *Citation (APA):*

Torresi, E., Fowler, J., Polesel, F., Smets, B. F., Andersen, H. R., Christensson, M., & Plósz, B. G. (2016). *Microbial biodiversity enhances micropollutants biotransformation in Moving Bed Biofilm Reactors (MBBR) with controlled biofilm thickness*. Abstract from International Conference on Emerging Contaminants (EmCon2016) and Micropollutants (WiOW2016) in the Environment, Sydney, Australia.

---

### **General rights**

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Please tick the relevant category:

Platform ☐ x ☐

Poster ☐

Either ☐

## Microbial biodiversity enhances micropollutants biotransformation in Moving Bed Biofilm Reactors (MBBR) with controlled biofilm thickness

Torresi, E.<sup>1,2</sup>, Fowler J.<sup>1</sup>, Polesel, F.<sup>1</sup>, Smets, B.F.<sup>1</sup>, Andersen H.R.<sup>1</sup>, Christensson, M.<sup>2</sup>, Plósz, B.G.<sup>1</sup>.

<sup>1</sup> Department of Environmental Engineering, Technical University of Denmark, Bygningstorvet, building 115, 2800 Kongens Lyngby, Denmark, info@env.dtu.dk

<sup>2</sup> Veolia Water Technologies AB – AnoxKaldnes, Klosterängsvägen 11A, SE-226 47 Lund, Sweden, info@anoxkaldnes.com

Diffusion processes and metabolic activity of the cells in biofilm can create concentration gradients of substrates along the biofilm. With increasing biofilm thickness these processes could be emphasized, thereby leading to higher biodiversity and to the proliferation of specific microbes capable of catalyzing micropollutants biotransformation. A previous study<sup>1</sup> demonstrated that higher biodiversity is required to maximize removal of a number of micropollutants in activated sludge. In our study, we investigated the impact of biofilm thickness and microbial diversity on micropollutants (n=22) biotransformation in three lab-scale nitrifying MBBRs. AnoxKaldnes<sup>TM</sup> Z-carriers with grids of defined heights were used to control maximum biofilm thickness at 500, 200, 50 µm. Batch experiments showed differences in micropollutants biotransformation rate constants ( $k_{bio}$ , L g<sub>biomass</sub><sup>-1</sup> d<sup>-1</sup>) within the three biofilms. Our observations (Fig.1) suggest that biofilm thickness positively associates with microbial diversity and with biotransformation rate constants for more than 60% of the targeted micropollutants (Pearson's  $r > 0.9$ ). On the other hand, diclofenac and three sulfonamides exhibited more efficient removal within the thinnest biofilm, which also presented the highest nitrification rate indicating hydroxylation by the mono-oxygenase enzyme reaction as the main removal route. Our results suggested that biofilm technologies with thicker biofilms (~500 µm) and thus exhibiting higher biodiversity may be an effective solution to maximize biotransformation and removal of several micropollutants.

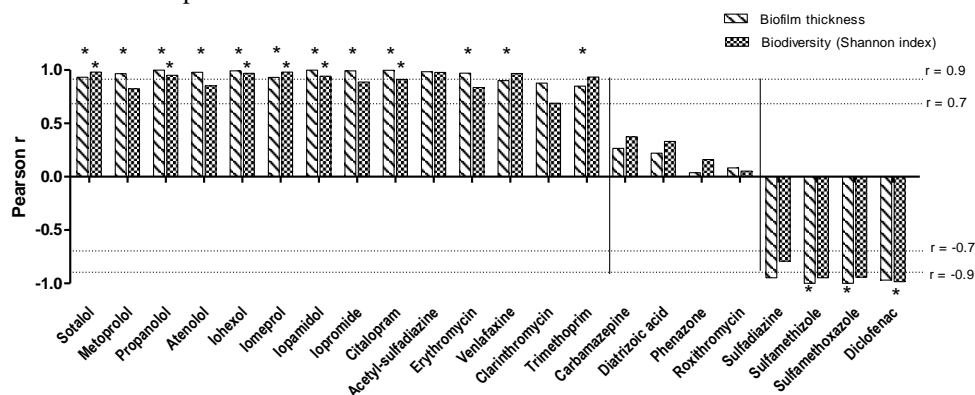


Figure 1 Correlation between the biotransformation rates of the targeted micropollutants with biofilm thickness and biodiversity (expressed as Shannon index).

**Keywords:** nitrification, pharmaceuticals, microbial structure, biofilms

1. Johnson DR, Helbling DE, Lee TK, et al. Biodiversity associates with the rates of micropollutant biotransformations among full-scale wastewater treatment plant communities. *Appl Environ Microbiol.* 2014;81(2):666-675. doi:10.1128/AEM.03286-14.